J. Perinat. Med.
2 (1974) 54

The fate of the child after threatened abortion*

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It is to the credit of modern perinatology that it looks beyond the perinatal period and now also includes the course of the entire pregnancy, when it considers factors influencing neo-natal morbidity. Moreover, obstetrical reports cannot give complete information about the effects of some complications of pregnancy, since ill-effects are not necessarily recognizable by the seventh day of life. When dealing with a significant deviation from the normal, one has to consider intra-uterine complications through a disturbed pregnancy, and this includes hemorrhages during the first half. Blood loss from the uterus during the first five months must be interpreted as a separation between the decidua and chorion (or placenta), as long as they do not arise from a low-lying pole of the ovum. As a complement to our previously reported investigations [15, 17] we have now followed up affected children and arrived at certain conclusions to add to the previously reported obstetric findings.

Curriculum vitae

Dr. H. J. WALLNER, *born in 1935 at Tirschenreuth/Oberpfalz. High school in Weiden. Studied medicine and assistant at the Surgical Clinic Rechts der Isar, then Assistant at the Dept. of Gynecology at Munich Technical University. Spent 1966 in the United States where he specially interested himself in work connected with filming. Since 1968 again at the Gynecological Clinic of Munich Technical University. Took his specialist's examination in 1971, and became Lecturer in 1972.*

1. Material and Method

The original material consisted of a series of 231 cases. These were women who had been treated in our clinic on account of threatened abortion

* By invitation of the editor.

Tab. I. Distribution of infant's weight after threatened abortion in three series (total of 615 cases) as compared to the weight distribution of newborns after an undisturbed pregnancy (10,000 children born during the same period of observation, chosen at random).

		weight of infant							
		under 2000 g	2000 g to 2500 g	to 2500 g total	2500 g to 3000 g	3000 g to 3500 g	3500 g to 4000 g	over 4000 g	total
With bleeding:									
Series I	no:	21	16	37	46	88	53	7	231
	%:	8.8	6.9	15.7	19.9	38.5	22.9	3.0	100.0
Series II	no:	23	22	45	40	87	63	5	250
	%:	9.1	8.7	17.8	15.9	35.4	25.0	5.9	100.0
Series III	no:	12	11	23	27	43	32	9	134
	%:	9.2	8.0	17.2	20.7	31.8	23.7	6.6	100.0
Without bleeding:									
	no:	261	445	706	1984	3673	2705	932	10,000
	%:	2.6	4.5	7.1	19.8	36.7	27.1	9.3	100.0

but later carried their pregnancies to term. To confirm our findings we then checked two more series of 250 and 124 cases each so as to have a statistically proved homogeneous group. In that manner we had a total of 615 clinically similar cases and contrasted these with 10,000 unselected and unaffected pregnancies during the same period (1959 to 1969), all from our clinic (Tab. I).
As far as possible, we later examined the children of the original series. The range of uniform clinical data which were elicited therefore extended from the first few weeks of the pregnancy until the 11th year of life. All the data were recorded on IBM cards (type 1130).

2. Obstetric Results

2.1 Frequency of premature births

The **incidence of prematurity** following a treated threatened abortion is roughly **2½ times the normal incidence:** 17.8%, 18.7% and 19.4%, as opposed to 7.23% (Fig. 1) (cf. JUNG and KLÖCK [7], KNÖRR [8], MAU and NETTER [10], WILKERSON, DONELLY and ABERNATHY [20]).

2.2 Perinatal mortality

The perinatal mortality after threatened abortion is elevated to 7% (43 cases out of 615). Fig. 2 shows the distribution of premature births and stillbirths within the individual series. In the majority of these cases the hemorrhages were first noticed during the second trimester. This observation is confirmed by JOHANNSEN [6].

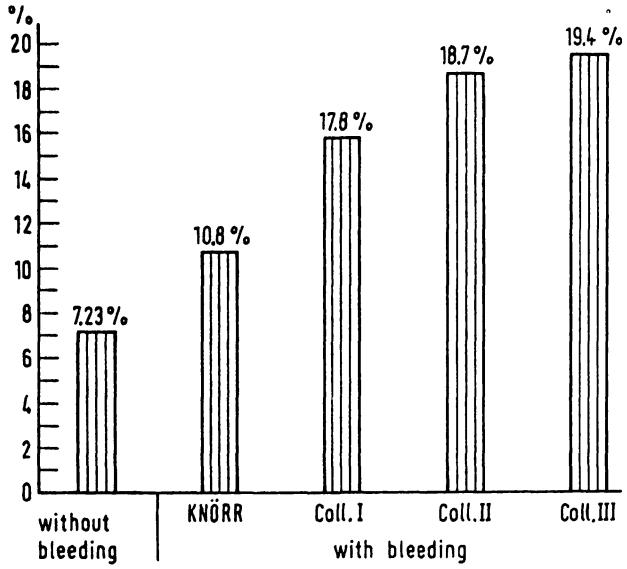

Fig. 1. Incidence of prematurity with and without bleeding during pregnancy.

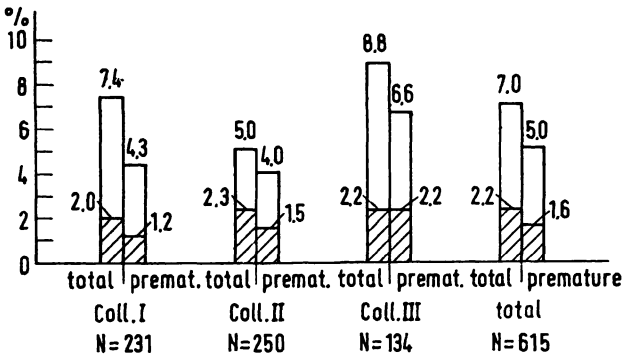

Fig. 2. Perinatal mortality after threatened abortion.

Tab. II. Findings of various authors concerning the frequency of malformations after threatened abortion.

(after WALLNER, WAIDL and WELSCH [16])

1—2%	2—3%	3—4%	4—5%	5—6%	Over 6%
JOHANNSEN (1970) 3:266	HOLLSTEIN 30:1171	ALKNER (1960)			
MATISSEK (1962) 5:300	HORVATH (1962)	ASANTI (1963)	KOTZ (1941) 5:102		
MORY (1962) 5:293	SHUTE (1937) 7:443	KNÖRR (1952) 9:226	WEINTRAUB (1968) 9:207		
WILKERSON (1967)		WIDOK and WIDOK (1967)		WALLNER (1972) 11:231	JUNG and KLÖCK (1967) 6:108

Frequency of malformations in unselected series after DEGENHARDT (1972), DFG, 1.73 %.

2.3 Incidence of foetal anomalies

There is no agreement about the incidence rate of anomalies after threatened abortion, particularly since we have no clear definition of what represent an anomaly Tab. II shows a summary of references.

3. Follow-up studies of children born after pregnancies complicated by threatened abortion

3.1 Material and method

Of the original series of 231 children 19 died a perinatal death. Three more did not survive their first birthday. 98 children were clinically examined, and 4 did not appear for such an examination. The fate of the other 107 is not known.

In our first series we observed 11 malformations in 231 cases, i. e. 4.7%. However, we later diagnosed a sacral teratoma which had not previously been noticed, and this child died during its first year of life as a result of the operation. This case would increase our **anomaly rate** to **5.1%**. In looking at our control series of 10,000 cases, using the same definition, we found 180 anomalies, indicating a statistically significant greatly increased anomaly rate after threatened abortion ($\chi^2 = 8.7662$).

At the examination the following data were elicited and investigations carried out:

(a) Social history of the family.
(b) Medical history and stages of development of the child.
(c) Conduct and performance in school or kindergarten.
(d) Clinical status.
(e) X-ray of carpal bones.
(f) Examination by ophthalmologist.
(g) Neuro-pediatric examination with E. E. G. (in all neurologically abnormal cases).

We then attempted to get a rough impression of the intellectual development of these children by using the classification of HELLBRÜGGE [6] in which language, conduct at games and adaptation to environment are given due consideration. The interpretation of the results of our examination followed by electronic data processing.

3.2 Results

3.2.1 Neonatal mortality

The **neonatal mortality** before the first birthday amounts to **6%**. Excluded in this figure are the children about whose development we were unable to get any information (107 cases). During the same period, according to figures published by the Bavarian Statistical Office, the neonatal mortality dropped from 38.0 in 1958 to 24.8 in 1970, per 1,000 live births. These figures would indicate that following a threatened abortion the **neonatal mortality is at least doubled.**

3.2.2 Retardation of development and weight

In the assessment of this factor we used the somatograms of VOGT [13] and BAYER and BAYLEY [1]. We considered those cases as pathological which were outside the range of both the somatograms. In sixteen children the size was below the normal and in nine of those the weight was also more than 2 S. D. below the normal for the gestational age.

3.2.3 Delayed ossification

In their atlas of the bones of the hands SCHMID and MOLL [12] have given the normal range of ossification in a middle European population. They claim that in 97% of children ossification in the bones of the hand will occur at the time shown in Fig. 3. In our series we x-rayed 74 children and found a delay in ossification in 13 (i. e. between $^1/_6$ and $^1/_5$ of the total). Fig. 4 shows the contrast between the normal development and the delayed ossification.

3.2.4 Ophthalmological findings

Pathological findings were reported in **24 of the 63 children** checked by ophthalmologists. The chief abnormality diagnosed were **squints** (8 cases), **restriction in the visual field** (7 cases), **diminished acuity of vision** (10 cases), **nystagmus, anomalies of refraction** and **hyperopia.** In some children several abnormal findings were recorded at the same time, and in 8 cases the findings were questionable. Only 31 out of 63 children were declared as normal by the ophthalmologist.

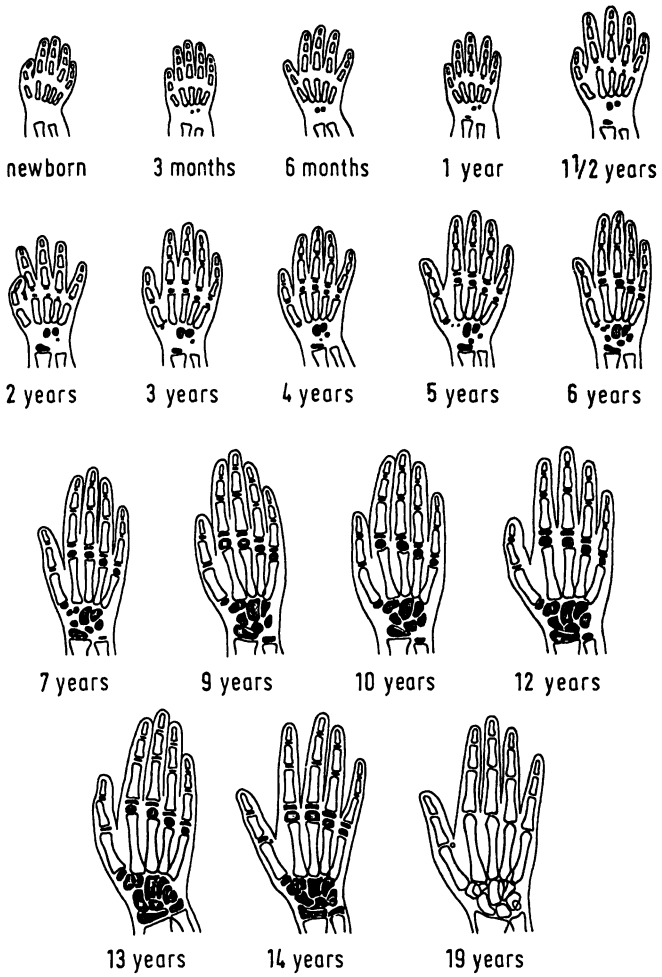

Fig. 3. Time of ossification of the bones of the hand (European population, SCHMID and MOLL [12]).

3.2.5 Intellectual development

It was impossible to get a comprehensive psychiatric examination on all the children. However, we did arrange for a psychological test on the children in our series. According to the classification of HELLBRÜGGE it was found that **29 out of 98 children were outside the normal range** with regard to one characteristic, 14 in regard to two characteristics and 1 to three. One child attends a special school. Two children have aphasic symptoms and 11 defective articulation. This latter observation is confirmed by WINICK [19] who has found frequent disturbances of speech after intra-uterine retardation.

3.2.6 E. E. G. findings

The results of the E. E. G. examinations are being prepared for separate publication (WEINMANN and WALLNER [18]). In 5 cases there were undoubted pathological recordings, and this represents **more than 5% of the total.** Borderline findings were reported in 9 further cases.

3.2.7 Unremarkable findings

Of the 98 examined children 56 showed none of the pathological manifestations referred to from 1 to 6 above. They appeared to be clinically healthy, with a physical and mental development in accordance with their chronological age.

4. Discussion

Our results show the **increased incidence of premature birth** and the **elevated perinatal mortality rate** after a threatened abortion which was previously suspected from the obstetrical reports. All pregnancies complicated by bleeding during the first half must, therefore, be considered as being at risk and should become part of any "prematurity and dysmaturity prevention program" which has been instituted, as has previously been pointed out by SALING [11].

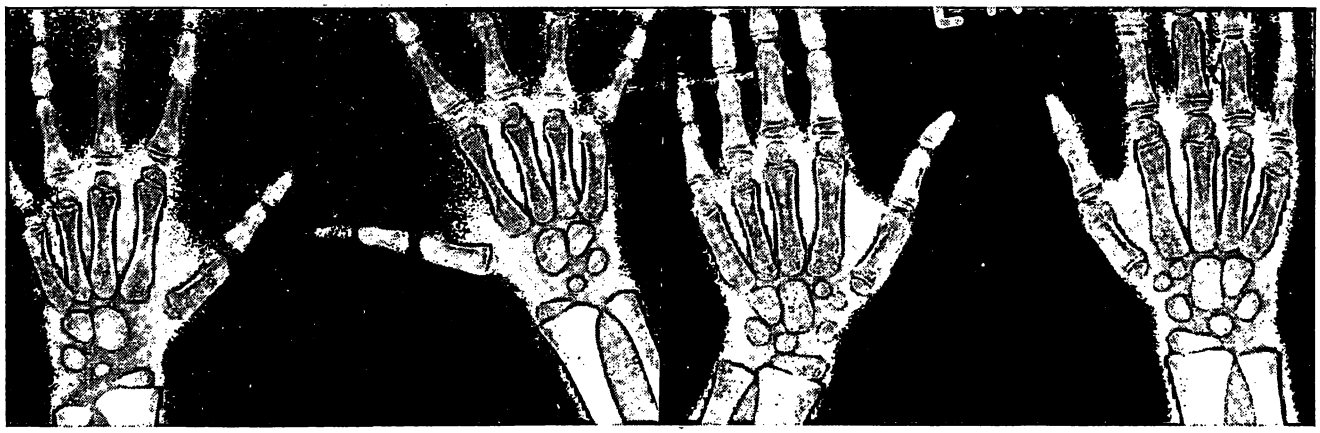

Fig. 4. Delayed ossification (left); normal ossification at same age (right).

Fig. 5. Histological demonstration of neuro-secretion in the fetal hypothalamus.

With regard to **malformations,** we feel that there is a **statistically significant increase** in the incidence after threatened abortions but this contradicts several other references in the literature. A possible reason for this discrepancy might be differences in definition and number of cases. There are reasons for assuming a connection between hemorrhages during the second trimester and perinatal mortality. According to DOBBING [3] the time between the 16th and the 20th week represents the first phase of intensive brain development. WAIDL et al. [14] have demonstrated that a neurosecretory hormone appears in the hypothalamus and hypophysis for the first time during the 5th month of fetal development, and this may be of special importance in connection with "Releasing Factors" (Fig. 5). The proper development of such endocrine organs as the adrenal depends on higher centres, as shown by DHOM et al. [2].

It is, therefore, very possible that a hemorrhage at this delicate stage of the pregnancy causes an ischemia or malnutrition which disturbs the synergism necessary for the proper development and functional start of the fetal endocrine system.

The evidence of **retarded development** found in some children at a later examination can be explained by premature birth in some of the cases. About $^1/_3$ of those showing abnormalities in the somatogram or ossification were born at full term and with an average weight. Other factors that might interfere with normal development, such as delay caused by sicknesses, social factors or environmental influences, did not appear to be of special importance when the mothers were questioned. Nevertheless, multifactorial aspects must always be borne in mind (FEHLHABER, FRIDEL, LEMPP, ROCKER and WACKER [4], LEMPP and WACKER [9]).

Although investigations of this kind are always associated with certain problems and uncertainties, we believe there is good ground for assuming that **hemorrhages during the first half of a pregnancy must be considered as a detrimental influence,** not only with regard to the birth itself, but also to the physical and mental development of the child. When contemplating the treatment of threatened abortion, therefore, each case must be considered on its merits, and it is questionable whether this should be carried out "at any price".

Summary

We have reviewed the results in three series comprising 615 cases of threatened abortion where the pregnancy went to term. Our findings lead us to the following conclusions:

1. The **incidence of premature births is 2½ times that of the normal.** This forces us to consider each pregnancy which is disturbed by bleeding during the first five months as being at risk.
2. The **perinatal mortality is elevated to 7%.** In the etiology of this complication, bleeding during the second trimester is of special significance.
3. The first decisive phase of brain development occurs during the second trimester when a special neurosecretion is present for the first time. A hemorrhage at that time might well interfere with the synergism of the fetal endocrine system, its development and first functioning. This may well cause a deficien adaptation leading to an increased perinatal mortality rate, even when the child is born at term.
4. In our series the **rate of anomalies is increased** but other workers have not found this. In later examinations we satisfied ourselves that no socioeconomic factors were at work to influence the normal development of the children. Those born prematurely distinctly showed a retarded development profile, at times to a considerable extent. However, not all cases in which biological age was less than the chronological, could be explained in this manner. The **high incidence of ophthalmological pathology** is remarkable. We cannot pass a definite judgment on the abnormal E. E. G. findings. **56 of the 98 examined children were pronounced normal.**

There can be little doubt that bleeding during the first half of the pregnancy interferes with the development of the conceptus. This can lead not only to obstetric complications but also to a retarded development of the affected children.

Keywords: Threatened Abortion, number of premature births, perinatal mortality, frequency of anomalies, neonatal mortality, physical and mental development, retardation of ossification, ophthalmological damage.

Zusammenfassung

Das Schicksal des Kindes nach überstandenem, drohenden Abort

Die wesentlichsten Ergebnisse einer Studie über den Geburtsverlauf nach Abortus imminens an 615 Fällen in 3 Kollektiven sind:

Die Frühgeburtenquote ist um das Zweieinhalbfache erhöht. Dies zwingt dazu, jede Gravidität, die durch Blutungen während der ersten fünf Monate gestört ist, als Risikoschwangerschaft, vor allem im Hinblick auf die Frühgeburtenprävention, zu betrachten. **Die perinatale Mortalität ist auf 7% erhöht.** In der Kasuistik dieser Fälle erhalten Blutungen des II. Trimenons eine besondere Bedeutung. Die erste, entscheidende Phase der Gehirnentwicklung, ferner das Erstauftreten des Neurosekrets in dieser Zeit und der Synergismus des fetalen Endokriniums in Entwicklung und Funktionsbeginn kann möglicherweise durch Blutungen in dieser Zeit gestört werden.

Hypothetisch ist eine **Mangeladaptation** aus diesen Gründen eine der Ursachen für die erhöhte perinatale Mortalität, auch der reif geborenen Kinder.

Die **Mißbildungsfrequenz** ist in den von uns bearbeiteten Kollektiven erhöht, wenngleich die Literaturangaben hierüber unterschiedlich sind. Bei den klinischen Nachuntersuchungen der Kinder kann zunächst davon ausgegangen werden, daß keine, die normale Entwicklung des Kindes beeinträchtigenden Faktoren des sozio-ökonomischen Bereichs innerhalb der untersuchten Gruppe eine Rolle spielen. Die Frühgeburtlichkeit spiegelt sich deutlich in dem teilweise **erheblich retardierten Entwicklungsprofil** wieder. Sie erklärt jedoch nicht alle Fälle, in denen das biologische Alter gegenüber dem arithmetischen reduziert ist. **Die hohe Zahl der pathologischen ophthalmologischen Befunde ist auffällig.** Über die Relation der pathologischen EEG-Befunde kann derzeit noch keine verbindliche Aussage gemacht werden. 56 von 98 untersuchten Kindern wiesen keine pathologischen Befunde auf.

Die gehäuft pathologischen, geburtshilflichen Befunde sind gesichert. Im Hinblick auf eine retardierte Entwicklung der betroffenen Kinder besteht Grund zu der Annahme, daß auch Blutungen der ersten Schwangerschaftshälfte als ursächliche Faktoren in Betracht gezogen werden müssen.

Schlüsselwörter: Abortus imminens, Frühgeburtenquote, perinatale Mortalität, Mißbildungsfrequenz, Säuglingssterblichkeit, somatische (und geistige) Entwicklung, Retardation des Ossifikationsalters, opththalmologische Schäden.

Résumé

Le sort de l'enfant à la suite d'un abortus imminens

Une étude sur l'accouchement après abortus imminens dans 615 cas répartis en 3 collectifs a donné les résultats suivants:

Le pourcentage des accouchements prématurés est deux fois et demie plus élevé. Ceci oblige à penser que toute gravidité qui est perturbée par des hémorragies durant les cinq premiers mois doit être considérée comme une grossesse risquée, surtout en regard de la prévention des accouchements prématurés. **La mortalité périnatale s'élève à 7%.** Dans cette casuistique, les hémorragies du II. trimestre sont d'une importance particulière, car elles peuvent perturber la première phase décisive du développement cérébral, puis la première apparition de neurosécrétion à cette période ainsi que le synergisme de l' endocrinium foetal dans le développement et le début de fonctionnement.

Une **adaptation défectueuse** consécutive est, hypothétiquement, l'une des causes de la mortalité périnatale élevée, même des enfants nés à terme.

La **fréquence des malformations** est élevée chez les groupes que nous avons observés, bien que les références dans la littérature diffèrent à ce sujet. Les post-examens cliniques des enfants ayant fait l'objet de notre étude n'ont révélé aucun facteur d'ordre socio-économique qui ait retardé de façon significative le développement de ces enfants. La prématurité se reflète nettement dans le profil de développement parfois considérablement retardé, mais elle n'explique pas tous les cas où l'âge biologique est réduit par rapport à l'âge arithmétique. **Le nombre élevé des résultats ophtalmologiques pathologiques est frappant.** On ne dispose pas encore de résultat définitif sur la relation des observations pathologiques des EEG. 56 sur 98 enfants examinés ne firent état d'aucun signe pathologique.

Les résultats gynécologiques pathologiques plus fréquents que la normale sont un fait certain. En ce qui regarde un développement retardé des enfants concernés, il y a lieu d'admettre aussi comme hypothèse de facteurs-cause les hémorragies durant la première moitié de grossesse.

Mots-clés: Abortus imminens, pourcentage des accouchements prématurés, mortalité périnatale, fréquence des malformations, mortalité des nourrissons, développement somatique (et mental), retardement de l'âge d'ossification, lésions ophthalmologiques.

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